

***Vital Signs* Town Hall Teleconference**  
**Innovative Approaches to Reducing the Risk of *Legionella* in the Environment and**  
**Preventing Legionnaires' Disease**  
**June 14, 2016**  
**2:00 pm ET**

Operator: Thank you all for standing by. Welcome to today's conference call. At this time your lines have been placed on listen only for today's conference until the question-and-answer portion of our call at which time you will be prompted to press Star 1 on your touchtone phone.

Please ensure that your line is unmuted and please record your name when prompted so that I may introduce you to ask your question. Our conference is also being recorded and if you have any objections you may disconnect at this time. I will now turn the conference over to our host, Ms. (Dagny Olivares). Ma'am you may proceed.

Dagny Olivares: Thank you. Good afternoon. I'm (Dagny Olivares), the Associate Director for Program Planning and Communication in CDC's Office for State, Travel, Local and Territorial Support. Thank you for joining us today. We'll be discussing the latest *Vital Signs* report on Legionnaires' disease.

Before we get started, let's go over some housekeeping details. You can go online and download today's PowerPoint presentation so you can follow along with the presenters. The web address is [www.cdc.gov/stltpublichealth](http://www.cdc.gov/stltpublichealth). That's S – T – L – T public health -- all one word. Look on the far right side of the page for the *Vital Signs* Town Hall Teleconferences link or you can Google, CDC *Vital Signs* Town Hall and click on the top link. That should get you there.

On the same webpage you can access bios for today's presenters and the audio recording and transcript which will be available next week. There will be time for questions after today's presentation, but you can get in the queue at any time to ask a question -- just press Star 1 and say your name when prompted. So let's get on with our topic for today, **Innovative Approaches to Reducing the Risk of *Legionella* in the Environment and Preventing Legionnaires' Disease.**

We're going to hear from three colleagues. First, we'll hear from Dr. Laura Cooley, who is a Medical Epidemiologist in the Respiratory Diseases branch of the Division of Bacterial Diseases at CDC's National Immunization and Respiratory Diseases. She's going to talk about the findings in this month's *Vital Signs* report. Then Dr. Robert Fitzhenry will present. He is the director of Waterborne Diseases in the Bureau of Communicable Diseases at the New York City Department of Health and Mental Hygiene.

He will discuss Legionnaires' disease caused by a cooling tower in New York City which occurred in 2015. He will then hand the call over to Bill Gaines who is a Principal Engineer at the Ford Motor Company. He will talk about Ford's Global Water Quality Management Program. And now I'll turn the call over to Dr. Laura Cooley.

Dr. Laura Cooley: Thank you and good afternoon. All right, I'll start on Slide 5.

Legionnaires' disease is a severe pneumonia that often requires hospitalization and is deadly for about 1 in 10 people who get it. It occurs in people who inhale small droplets of water contaminated with *Legionella*. Human made water systems provide the opportunity for *Legionella* to grow and spread. Legionnaires' disease can affect anyone, but some people are at an increased risk, such as adult's 50 years or older, current or former smokers, or people

with chronic lung disease or people with a weakened immune system from diseases or medicine.

Slide 6. During 2000 through 2014, the rate of reported cases of *Legionellosis* -- which comprises both Legionnaires' disease and Pontiac Fever --increased 286%. Currently, approximately 5,000 cases and at least 20 outbreaks are reported to CDC each year. However, Legionnaires' disease might be underdiagnosed.

Next slide. Legionnaires' disease outbreak investigations require an environmental assessment to identify potential sources of exposure. CDC reviewed all investigation summaries and associated publications describing Legionnaires' disease and outbreak investigation conducted during 2000 to 2014 to identify possible root causes that could facilitate *Legionella* growth and spread.

Sufficient information to evaluate maintenance deficiencies was available for 23 investigations. Findings were assigned to one or more of four categories. About two in three were due to process failures in which a process such as a water management program was missing or inadequate. About 1 in 2 were due to human errors in which a person did not perform as expected such as not replacing hot test filters according to manufacturer's recommendations.

About one in three were due to equipment failures in which a piece of equipment did not operate as expected such as a malfunctioning disinfectant delivery system. About one in three were due to unmanaged external change leading to changes in water quality due to events occurring outside a building water system such as nearby construction. About one in two outbreaks were found to be due to more than one of these problems.

Next slide. We looked at 27 outbreaks to determine the most common settings and sources. The most frequent settings were hotels and resorts, long-term care facilities and hospitals. The remaining outbreaks were among senior living facilities, work places and the community. Potable water was the most frequent source of exposure followed by cooling towers, hot tubs, and a decorative fountain.

The results of one outbreak due to industrial equipment and for two outbreaks - a source was not identified. Next slide. Because *Legionella* transmission occurs from human made environmental settings, the most effective strategy for prevention of Legionnaires' disease is through control of *Legionella* in building water systems.

In 2015, ASHRAE -- formally known as the American Society of Heating, Refrigerating, and Air Conditioning Engineers - published a consensus standard for the primary prevention of Legionnaires' disease, which called for the development and the implementation of water management programs in large or complex building water systems.

The standard, which is based on best practices, focuses on identifying hazardous conditions and applying control measures to interrupt *Legionella* growth and spread. Other standards addressing hazardous conditions in building water systems are anticipated to be published soon. The multi-step process begins by determining if a building as an increased risk for growth and spread of *Legionella*.

CDC developed a tool -- part of which is shown here -- to help make this assessment. If the building is at increased risk for *Legionella* growth and spread, a water management program will be necessary. The steps are described here. The formation of a specialized management team is required.

The team must then describe the building water system using words and diagrams, identify areas where *Legionella* could grow and spread, decide where control measures should be applied and how to monitor them, establish ways to intervene when controlled limits are not met, make sure that the program is running and is effective, and then document and communicate all activities. Taking these steps should reduce the risk for *Legionella* growth and spread.

How can state and local health officials help? They can incorporate *Legionella* water management programs into licensing and accreditation requirements for healthcare facilities; consider changing building and public health codes to include *Legionella* water management programs; provide tools and information to local building owners and managers help them carry out *Legionella* water management programs; and investigate reports of Legionnaires' disease promptly to prevent more people from getting sick.

Next slide. CDC and partners developed a toolkit to facilitate implementation of this new standard entitled Developing a Water Management Program to Reduce *Legionella* Growth and Spread in Buildings – A Practical Guide to Implementing Industry Standards. This toolkit helps identify buildings at increased risk of growing and spreading *Legionella* and develop and use a *Legionella* water management program that is comprehensive, effective, and in line with industry standards.

Thank you, and now you will be hearing from Robert Fitzhenry from New York City.

Dr. Robert Fitzhenry: Good afternoon everyone. Thanks Laura. So I think Laura set pretty much the scene describing the increase in Legionnaires' disease throughout the

country. If you go to – if we start on Slide 15, you’ll see the epidemiology of Legionnaires’ disease in New York City and this mirrors the increase that is seen nationwide, but what you’ll see in the “uncertain” -- the color focusing on uncertain cases -- is these are cases are not investigated or not attributed to an outbreak or a cluster in a building or a cooling tower. So for a vast majority of our cases, we don’t know what source is causing those cases and I think that that’s an area for future work.

If you go to Slide 16, this describes our surveillance. We have an electronic lab reporting system where we get all of our lab reports of *Legionella* reported electronically. Each one triggers a case investigation which is an investigation that looks at chart abstractions of clinical history and also a standardized questionnaire to interview cases and get a look at exposure history.

This typically takes about two to five days and this information is then inputted into various analyses -- and some of these are described below under “Signal Investigation.” So the first one is SatScan which looks at clustering cases in space and time using an online tool -- that’s freely available to everyone --and that can be incorporated in your work.

The next one is the Analyst of the Week report which signal is based on home address and looks at the previous four week cases and looks for a signal of two standard deviations above an adjusted historical baseline - so this is the historical limits method that’s commonly reported in MMWR. Another method that we use is a proximity scan where we look at three or more confirmed or pending cases based on home or work address occurring within .1 mile of each other within 30 days and this is actually a recent addition and we’re sort of, so, to some degree, road-testing that. We haven’t had a signal based on that yet.

And if a disease reviewer identifies three or more cases you visit the same area within 30 days because humans are really good at spotting things. If you switch now to Slide 17, I'll begin describing the outbreak that occurred in 2015. So, the signal on July 17, 2015 as part of routine surveillance -- so it was one of those methods -- it detected eight cases of Legionnaires' disease in the area of the South Bronx.

On review of the cases, no common buildings were visited by many of the patients and most homes were spread across seven zip codes -- which is a reasonably large area in a high density city -- so there's a lot of possible - I will say this, for example, this area's one of the highest retail densities in the city -- so outdoor dissemination was most likely exposure and the cooling tower as probable source.

Slide 18. So an outbreak case had Legionnaires' disease clinical illness and laboratory tests spent time in the seven zip codes and symptom onset was after July 1. We did outreach to clinicians via Health Alert and calls. We asked them to consider Legionnaires' disease when someone presented with symptoms that might cause someone to think of pneumonia, treat with antibiotics, and tests include -- and especially we asked that people would collect respiratory samples for culture because these are rare and they allow us to link clinical cases with environmental isolates.

The medical examiner performed autopsy for case investigation and specimen connection. We notified other jurisdictions to help identify cases elsewhere to (Epi-X) and phone calls. We go to Slide 19.

So environmental source identification. What we wanted to do was to locate cooling towers. The problem is that owners are not -- well, were not required to register cooling towers, so what we did was there was this -- some -

someone pointed out that you could look at data at a registry of people that would claim essentially a tax break because they're putting water mist into the atmosphere through their cooling tower and not into the sewage system -- so since they're not using the sewer system in that -- for that water, they get a tax break -- so there was a list of those -- and also Department of Buildings had a list of cooling towers that were in plans for buildings.

But we also use satellite imagery and reports from outside of New York City and the image that is shown there and in the smaller image which shows the fan of a cooling tower, this was a case that was reported by - through CDC -- someone from outside of New York City -- that stayed at this -- in this building and we noticed that on review of the satellite imagery there was a cooling tower so we were notified, I think, at about 10:33 and we were there about 12:00 o'clock to sample that cooling tower.

Next slide, 20. Environmental testing. So for sampling at the cooling towers we collected water from pools, collected swabs from biofilm; we tested disinfectant levels. Then the next part that is important is what we did is we used polymerase chain reaction -- PCR test -- to screen for areas to focus on because culture -- culturing *Legionella* is difficult and resource heavy.

So - but it's important to remember that culture is the gold standard and it because it demonstrates a viable organism is present, it's - also allows us to isolate for comparison -- but it takes between five and 14 days for growth.

You can initially see an isolate on - after five days, but you may not be able to pick it and you may have to subculture and by 14 days maybe you've got your answer. But PCR can't tell if the bacteria is alive or dead, but it does give you very -- results very quickly within hours and can focus testing and help give confidence to remediation orders. In other words, we were - we had a large



number of cooling towers and then we surveyed them and we wanted to have some sort of data to tell them to disinfect.

So if you go to Slide 21, this shows the epi-curve of the cases and the total number was 138 cases with 93% hospitalized and 12% deceased and for those of you with long memories, if you look back to the 1976 outbreak that gave Legionnaires' disease its name, you'd look at similar numbers which is kind of interesting.

Slide 22. We tested 55 cooling towers by PCR. We detected *Legionella pneumophila* serogroup 1 DNA in 21 of those cooling towers to 38%. We ordered to start remediation based on these PCR results, and by culture, 14 of them had LP-1 by culture - and so that's 25% of the cooling towers had culture positive for *Legionella pneumophila* serogroup 1.

And if we switch to Slide 23. So the next step was to identify the outbreak source and what we used was initially we used pulsed-field gel electrophoresis and on this little map on the right-hand side, well, you can see the cooling towers are the triangles and the circles are the cases -- and these are the cooling towers with LP1 by PCR.

And these isolates that we then got -- we compared to 26 patient isolates -- which we felt was a lot -- we don't, in New York City, routinely get clinical isolates; I'd say, 95-99% of our tests are urine antigen tests which don't allow this kind of comparison -- and it was indistinguishable, the patient isolates were indistinguishable from each other by PFG and indistinguishable from the Cooling Tower A by PFG.

So follow-up sampling at cooling towers is Slide 24. After the cooling tower remediation had begun collected to follow-up water samples and swab

samples. Cooling Tower B was also LP1 positive by PCR, but it wasn't in the initial sampling and this isolate was obtained -- and this is indistinguishable from the patient cluster by PFG -- so this is another tower that will have a similar PFG pattern to the patient isolate --so both Tower A and Tower B by PSG had the same pattern.

If you turn to Slide 25 - and this is really the data coming together -- is that the Cooling Tower A and Cooling Tower B when you compare them, the location, both were at the top of a building -- although that the hotel building was slightly higher. Nearby cases, Cooling Tower A. There were two cases in the hotel guests and there were four cases in the supportive housing on the same city block.

There were no cases in the housing shelter of the Cooling Tower B. The, clustering - 56 cases over 26 days of the outbreak period like were clustered around Cooling Tower A; whereas only 33 cases over fewer days of the outbreak period were clustered around Cooling Tower B.

The Cooling Tower A and B were indistinguishable from the patient isolates by PSG -- as I already mentioned -- and they were also indistinguishable by sequence based typing which looks at seven alleles in the genome - and so these were also indistinguishable from the patient's isolates by SBT.

And then they were -- Cooling Tower A was indistinguishable from the patient isolate by whole genome sequencing; whereas Cooling Tower B had a snip difference. And I must - to say that using all this data together, this allowed us to state that Cooling Tower A was the most likely source. If you look at Slide 26, due to this outbreak in New York City put emergency rules in place as did New York State. Rules were effective May 9, 2016.

These rules required that cooling towers be registered, that they develop and submit a maintenance plan, that they be inspected by a qualified inspector every 90 days, that there is biannual cleaning and disinfection, and that there's regular water chemistry and heterotrophic plate counts -- so that's anaerobic bacteria -- and that there's also testing for *Legionella* every 90 days -- so a sample -- a water sample --- must be collected and tested for *Legionella* every 90 days and the city is beginning annual inspection of these cooling towers.

And that's it on Slide 27. I just thank everyone -- and over to Bill now.

Bill Gaines: Thank you Robert, and good afternoon everyone. Slide 28. I'm Bill Gaines from the Ford Motor Company. I'm here today to convince you within the next ten minutes that your organization should have a Water Quality Management Plan. I also hope to demonstrate that is not at all difficult and will produce quantifiable results - although I do admit, will be time consuming.

I leave it to you whether to hire someone or self-perform the work. Don't think that this is so complex that you need to spend tens of thousands of dollars to hire experts to develop a program for you; rather, I would argue that no one knows your system better than you do.

Slide 29. Global Water Quality Management Program. Doesn't that say it all? How to manage water quality to protect the health and safety of our employees and visitors while providing asset management to increase the life of equipment.

Ford began our program over 15 years ago -- so it's quite mature -- the Ford standard has required all manufacturing facilities and maintain facilities worldwide. Now we purposely chose to be entirely prescriptive. Our Ford

production system is a very rigid and data driven process, but you know your systems better than I do, so I'll leave the decision to be prescriptive or to all flexibility of facilities up to your team.

Similarly, the decision to sample for *Legionella* can only be made by having detailed ballots of your specific processes.

Slide 30. When we began in 2001, we first reviewed all the guidance documents that were available. There were some general agreement, but many of the documents were either contradictory or incomplete.

Slide 31. By 2005, there was beginning to be more alignment, but contradictions still remained. Notably, in the question of whether or not to test for *Legionella*. This still remains a subject of heated debate today.

Slide 32. Our program was based on the principles of Failure Mode and Effects analysis (FMEA), and Hazard Analysis and Critical Control Points - HACCP.

The cross functional team included engineers, toxicologists, medical, and operations personnel. We didn't call it HACCP at the time, but it was essentially the process that we were following. This predates ASHRAE by over a decade. We coupled this with FMEA and known case history, along with the potential for application and exposure.

We then rated each system as, "Low," "Medium," or "High. This determined the number of control points and the measurement frequencies.

Slide 33. Each of the 24 systems that you see in the left-hand column is controlled, though, as I'll show you shortly. Some of them more thoroughly

than others. We also identified negligible risk systems as well as criteria that allowed a facility to exclude certain systems.

Slide 34. We then developed numerous supporting materials for the GWQMP. These included a training course that was given to key individuals at each facility and is now used Windows for individuals or replaced, so supporting attachments provide routine producers and response procedures when positives are obtained.

All test results are entered into a laboratory information management system that includes a searchable database. One of the key elements of our program is that we only allow a specific oxidizing and non-oxidizing biocides that have been proven effective against *Legionella*. All of our suppliers may only use biocides on the approved biocides list.

We have on our Ford intranet, a *Legionella* toolbox which contains the program itself, supporting procedures, and required record-keeping documentation.

Slide 35. For each of the 24 systems that were shown on the left that are controlled, the GWQMP provides a narrative describing typical uses at Ford, diagrams, and pictures so each of our worldwide facilities can understand with certainty what is being controlled.

Let me using cooling towers as an example of a high-risk system which is highly controlled and monitored. [I just lost the presentation]. As you may know, the furthest known cooling tower aerosolization causing Legionellosis was over six kilometers in France in 2003. Ford has over 300 cooling towers. I don't know how many people pass within six kilometers of those 300 towers each day, but it's certainly measured in hundreds of thousands of people.

Slide 36. Here's the list of tasks required for cooling towers and their minimum frequencies.

Slide 37. These done sampling, each system has as response action depending on the level of *Legionella*. Resampling is required 7 to 14 days after biocide addition. This is to allow the system to stabilize, to steady state conditions prior to resampling. We didn't want someone to sample one day after, say, a hyper-chlorination, and get a false sense of security.

Slide 38. Here's a very low risk system. For example, a gas tank is submerged in city water, pressurized with air, and the operator looks for any bubbles. In this case, we all may require annual disinfection and for the tank to be drained weekly and refilled with fresh, potable water.

Slide 39. CDC just published in the last week's *Vital Signs* that maintenance deficiencies and building water systems were a major source of the Legionnaires' disease outbreaks.

They concluded that properly implemented programs could reduce growth and transmission of *Legionella*. I say it will. Let me give you some comparative statistics. Turetgen found 26% of cooling tower samples *Legionella* positive. Kusnetsov found 47% of cooling systems positive. It does work.

Slide 40. Initially, it took effort over this whole process. It has been refined over time, it has changed as new information becomes available, but now it requires very little time at all and so I ask you to create a team and begin to evaluate your systems. The legal reasons. Many predicted ASHRAE 188 -- the New York State regulations --- will lead to increased litigation.

For economic reasons. This program reduces corrosion, improves heat transfer efficiency, and extends the lifetime of the equipment. But most of all, for health and safety reasons. To reduce the risk of Legionnaires' disease. People have a right to leave work as healthy as they arrived.

So in conclusion, I ask you to consider the benefits that you and your team can achieve. "A journey of a 1,000 miles begins with a single step." Begin tomorrow. Thank you. And now let me turn it back over to CDC.

Dagny Olivares: Thank you to all of our presenters. Those are truly excellent presentations with very good information to share. I want to just warn everyone on the phone that we are experiencing a somewhat severe weather here in Atlanta, so I apologize if there are any audio issues in the next portion of our *Vital Signs* Town Hall.